

Citation for published version:

Cooper, S, Hammond, G & Norman, J 2014, 'Potential for use of heat rejected from industry in district heating networks, UK perspective', Energy Systems Conference, London, UK United Kingdom, 24/06/14 - 25/06/14.

Publication date:

2014

Document Version

Early version, also known as pre-print

[Link to publication](#)

Publisher Rights

CC BY

University of Bath

Alternative formats

If you require this document in an alternative format, please contact:
openaccess@bath.ac.uk

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Potential for use of heat rejected from industry in district heating networks, UK perspective



EPSRC Grant EP/K011774/1

Samuel J. G. Cooper, Geoffrey P. Hammond, Jonathan B. Norman

University of Bath

sjgcooper@bath.edu, 01225 385366



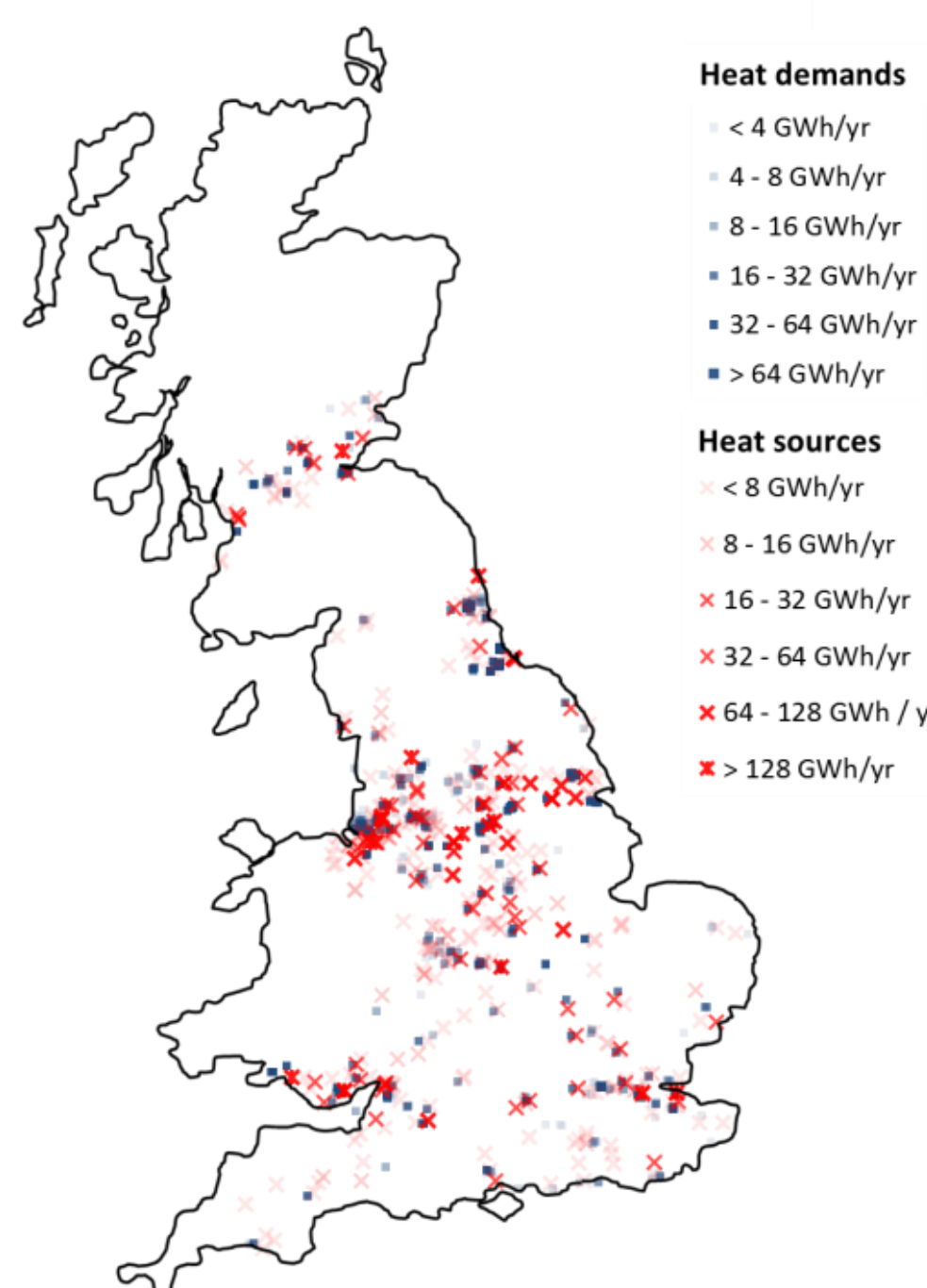
Background

- District Heating Networks (DHN) could act as an enabler for low carbon space heating. In the UK, 4.4 to 6.5 million dwellings and 15.8 to 20.7 TWh/yr of non-domestic space heating demand could be supplied by DHNs^[1].
- Waste heat is potentially available from industrial sites across the UK^[2].
- **This study considers the extent to which these heat demands and sources could be connected.**

Approach

1. Potential heat rejection from 425 industrial sites (low estimate: 10.1 TWh/yr, high estimate: 20.3 TWh/yr)^[3].
2. Heat demand density across the UK at 1 km² resolution^[4].
3. Heat available from each site was allocated in turn to nearby demands according to criteria (e.g. distance and heat density of demand) and simple prioritisation.

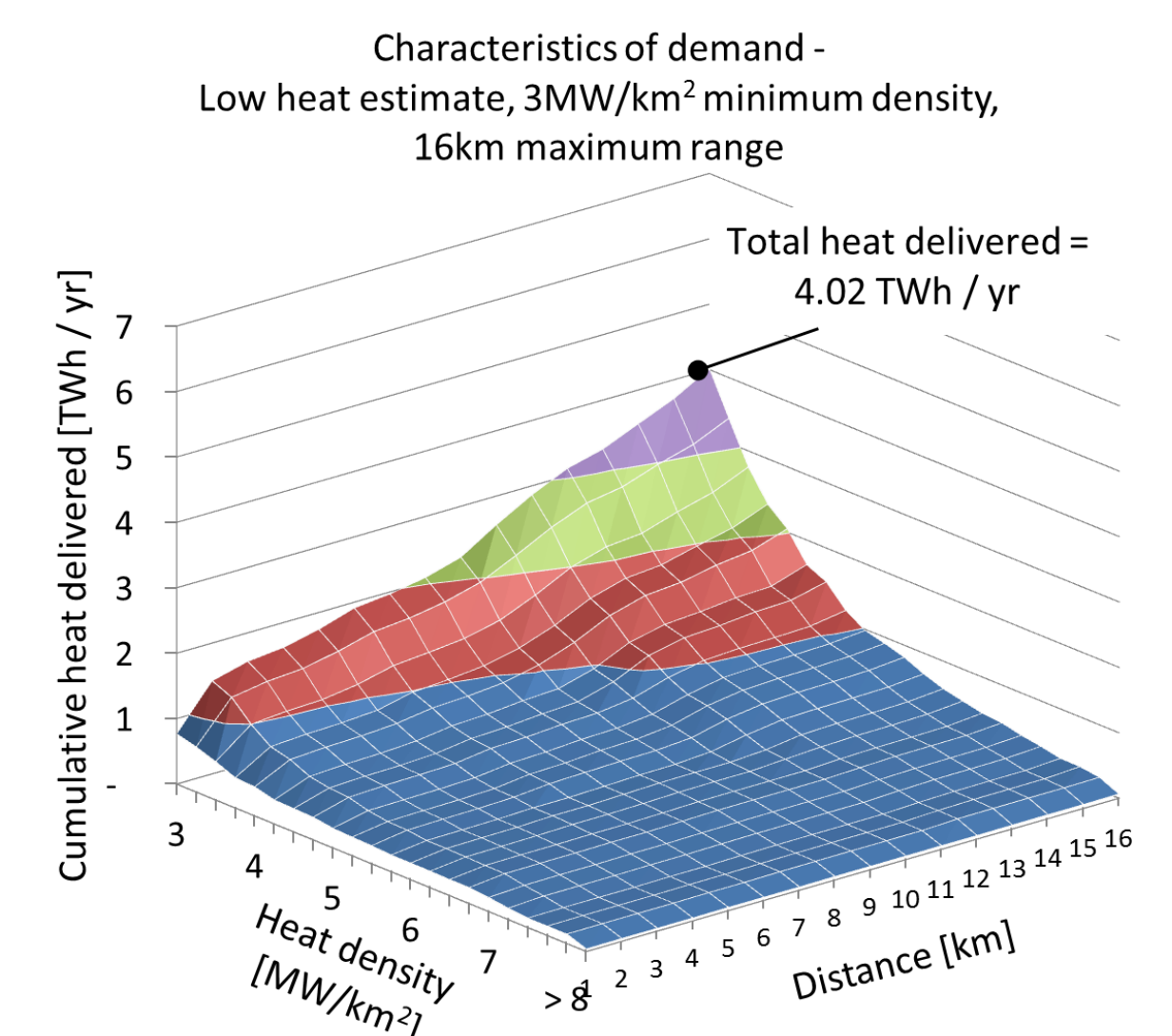
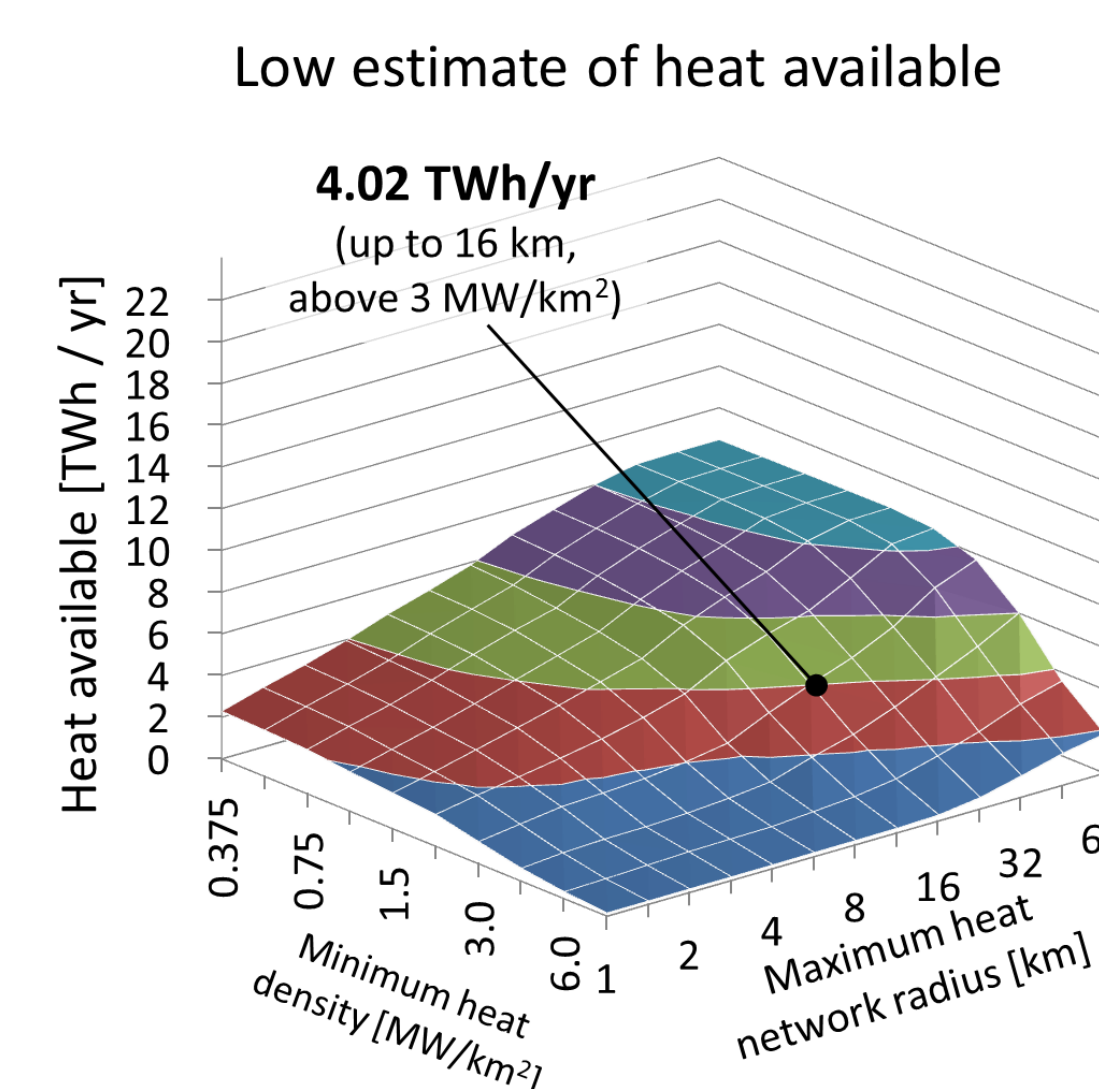
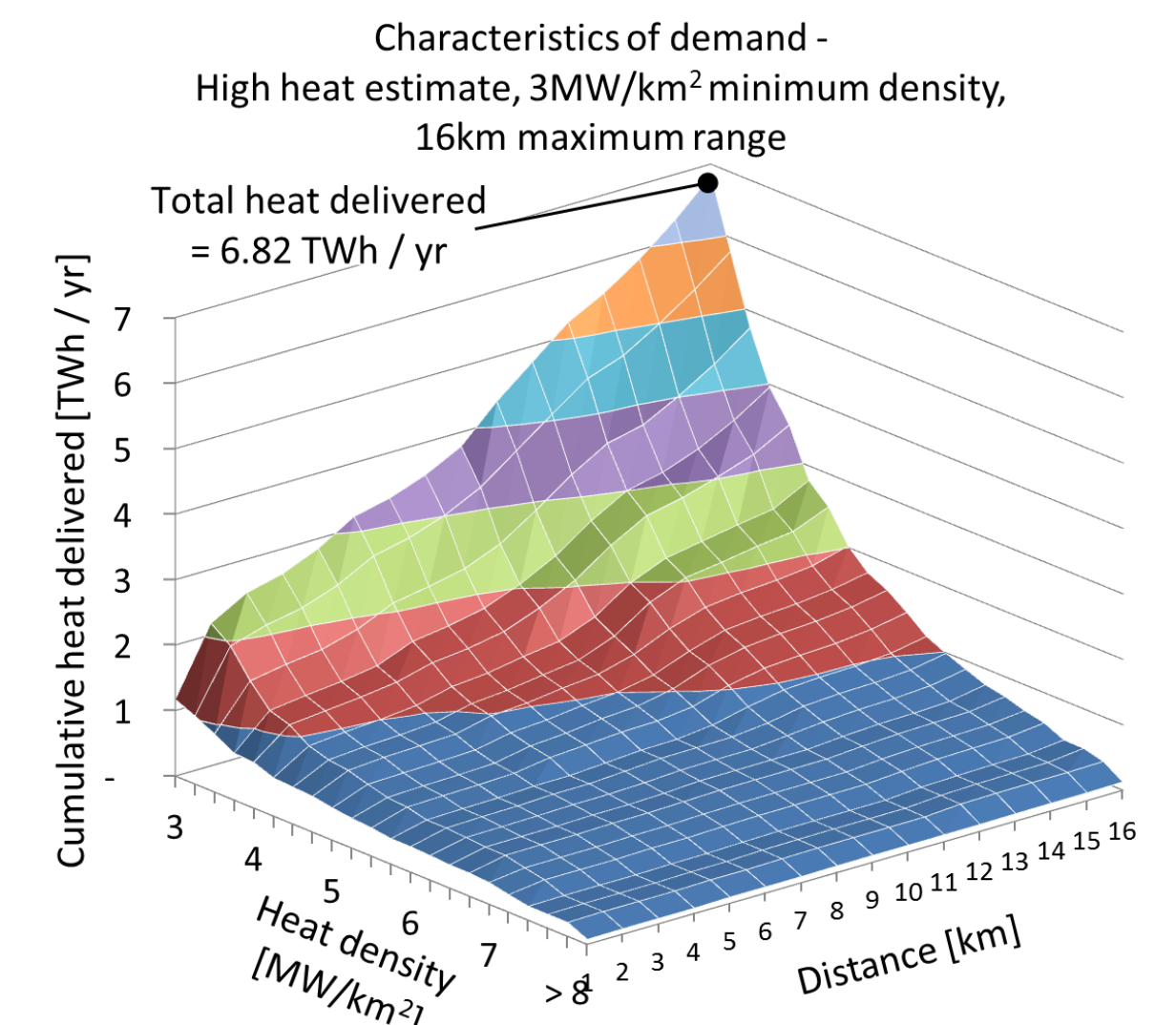
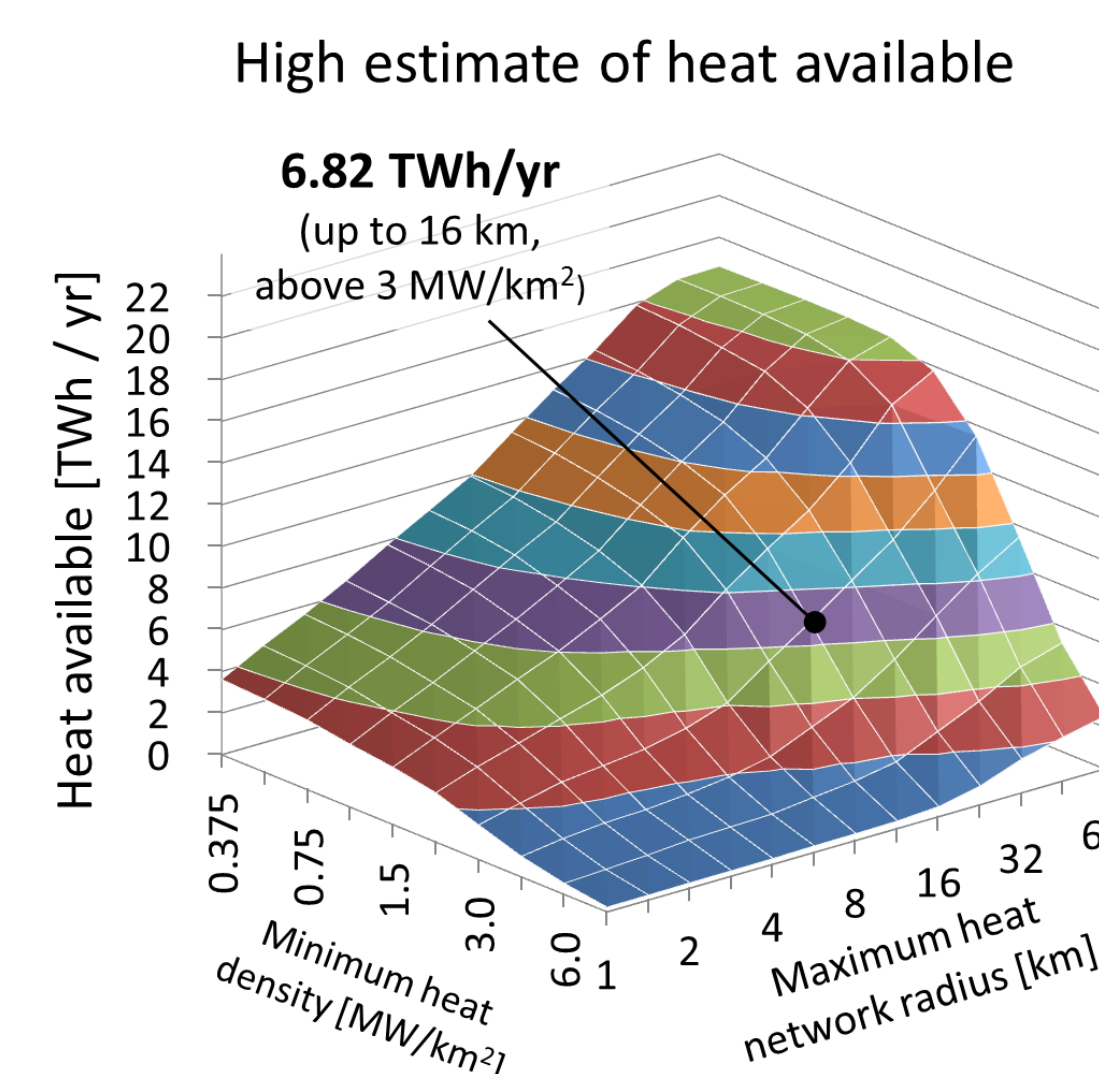
Heat demands and sources connected (3MW/km², 32km range criteria)



Results

Heat delivered under different maximum distance and minimum density criteria:

Characteristics of demands to which heat is delivered:



Heat delivered is insensitive to minimum feasible heat demand densities below 1.5 MW/km².

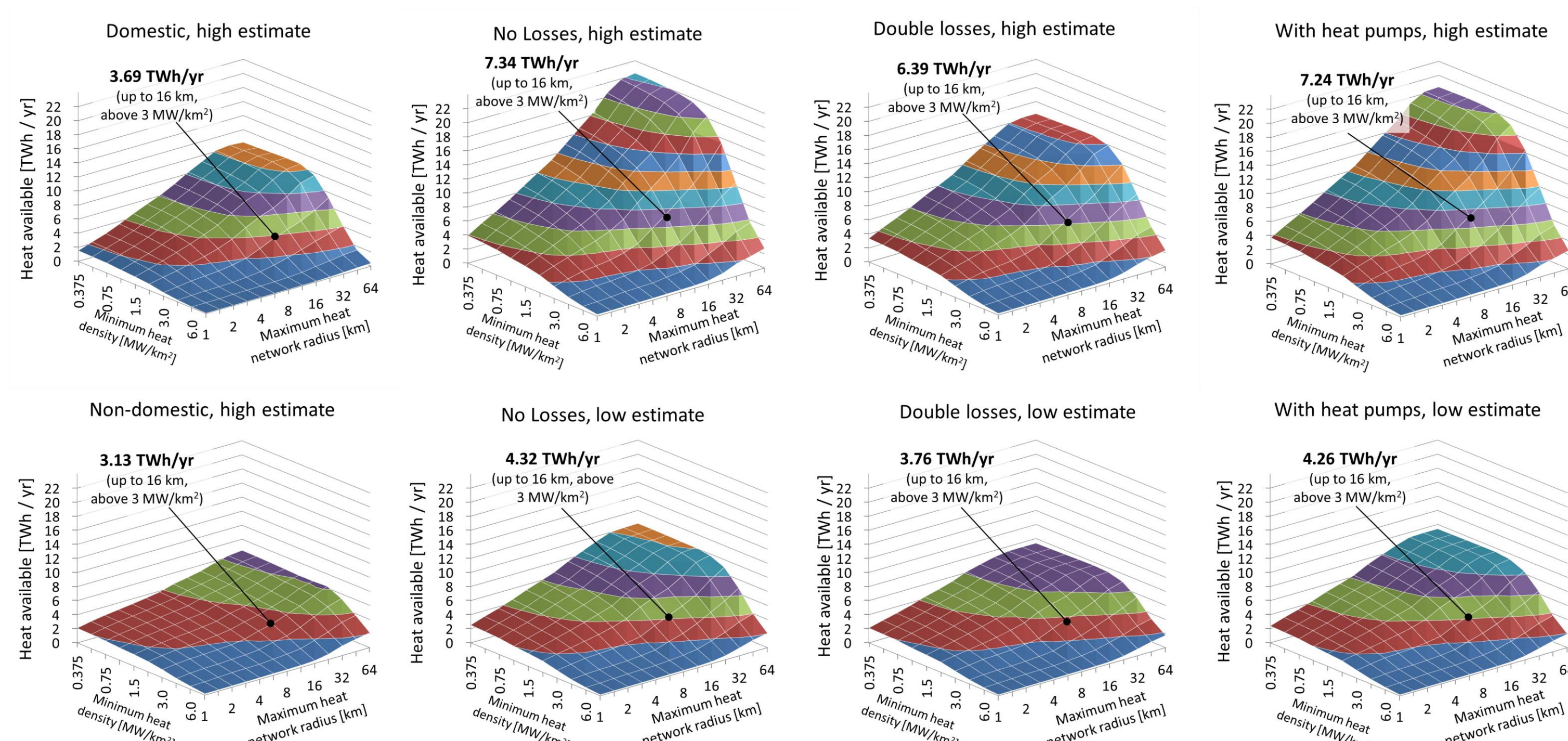
High density heat demands are supplied but over half of transfers are to heat densities below 4 MW/km². A third of the heat supply is accounted for by transfers of less than 2 km but transfers of up to 7 km are needed to account for half of the heat supply

Sensitivities

Domestic / non-domestic

Effect of removing / doubling heat losses in distribution

With heat-driven heat pumps



Domestic demands are greater overall but highest heat densities are non-domestic

For baseline conditions, heat losses have relatively small effect on heat delivered (6-8% change with removing or doubling losses) as available demand is constraint. If relaxed conditions allow longer transmission, the effect of losses increases to around 20%

Only 5% increase in overall heat delivered

Conclusions

Under the baseline criteria, only 34% to 40% of the heat which is rejected from industrial sites can be used, despite total demands being greater.

In order to use more than 75% of the high-estimate heat resource, the heat would need to be transported up to 45km and include areas with heat demand densities as low as 1.5 MW/km².

Thanks to Dr. Simon Taylor for access and interpretation of the DS4DS heat demand database

1. Davies, G., & Woods, P. (2009). *The potential and costs of district heating networks*. Oxford: Poyry Energy (Oxford) Ltd.
2. McKenna, R. C., & Norman, J. B. (2010). Spatial modelling of industrial heat loads and recovery potentials in the UK. *Energy Policy*, 38(10), 5878–5891.
3. Hammond, G. P., & Norman, J. B. (2014). Heat recovery opportunities in UK industry. *Applied Energy*, 116, 387–397.
4. Taylor, S. C., Firth, S. K., Wang, C., Allinson, D., Quddus, M., & Smith, P. (2014). Spatial mapping of building energy demand in Great Britain. *Global Change Biology – Bioenergy*, in press.